

## AN UNUSUAL BLACK FLY (DIPTERA: SIMULIIDAE), REPRESENTING A NEW GENUS AND NEW SPECIES

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*Abstract.*—The male, female, and pupa of *Piezosimulium jeanninae* are described and illustrated. These specimens (consisting of various portions of 2 males, 1 female, and associated pupal parts) represent a new genus and new species in the family Simuliidae. The new genus is readily distinguished from all other genera of the family by the presence of a conspicuous sperm pump, and a distinct, sclerotized, setose plate situated ventrally between the bases of the male gonocoxites. This is the first record of such structures in the family Simuliidae. The sclerotized plate is of unknown homology, but it might be a remnant of sternite 9 (hypandrium). A combination of several other characters, especially the slender katepisternum, the erect to semi-erect pile on the scutum, the large calypter, and the small eyes of both sexes are also characteristic. Under the present family classification this genus is a member of the tribe Prosimuliini, and is possibly the sister group to the other taxa in this assemblage, and possibly the sister group to all known black flies.

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Specimens of the following taxon have been known since early 1983, when they were received for identification along with a series of other species from Mr. Bruce Wahle, at the time a graduate student at the University of Colorado. The male was immediately recognized as undescribed but was put aside for later description with a number of other new species. At that time, I had not removed the existing portions of the fully developed male from the pupal skin, and it was only some time later, as I was looking more closely at the species, that I saw the very distinct sperm pump within the male abdomen. Subsequent attempts by the author, and others from the Institute of Arctic and Alpine Research at the University of Colorado, failed to collect additional specimens of this unique species. In view of the fact that neither a sperm pump nor a prominent sclerotized plate in the terminalia, as described below, have been reported for the family Simuliidae, and because additional specimens of this new genus and species might not be collected again for many years, as happened with *Parasimulium* Malloch, it is deemed worthwhile to describe this new taxon on the basis of the material at hand. Moreover, 2 major works have recently been completed dealing with various aspects of the phylogeny of the family Simuliidae (Currie, 1988, Ph.D. thesis; Wood and Borkent, in press), and it seems expedient to publish this information as it should shed new light on the phylogeny of the family and its relationships with other members of the Culicomorpha, especially the Chironomoidea. It must be recognized that if, or when, additional specimens are collected, these descriptions will require modification and additions.

### ***Piezosimulium***, new genus

Type species: *Piezosimulium jeanninae* Peterson, by present designation.

*Characters of the genus.* Antenna with 9 flagellomeres. Occipital foramen larger

than normal with combined hypostomal bridge and postgenal areas distinctly longer than dorsomedial occipital sclerite. Wing veins with fine setae only; Rs with a long, somewhat obscure fork; base of R setose; calypter subquadrate, somewhat larger than in other black flies. Calcipala and pedisulcus absent. Scutum with moderately long, erect to semi-erect pile, no recumbent setae. Scutellum depressed and flattened, nearly rectangular, slightly pointed posteromedially. Katepisternum moderately slender and narrowly rounded ventrally (but not as slender or narrowly rounded as in *Parasimulium*), with a slight depression but without a distinct sulcus or groove separating upper and lower portions. *Male*: Eyes small with resulting broadened orbits and vertex; facets of eye gradually increasing in size dorsally without a sharp line of demarcation between smaller lower facets and larger upper facets; number of larger, upper facets reduced as compared to male eyes of other black flies. Eyes narrowly but distinctly separated along midline, at medioventral angle by at least width of an eye facet, and at mediodorsal angle by width of about 3 or 4 large, dorsal facets; frontal area between eyes with sparse, short setae; inner margin of eye at level of antenna with a narrow, facetless, crescent-shaped, thickened margin (=ocular triangle or notch) (Figs. 1, 2). Body of ventral plate of aedeagus, in terminal view, somewhat W-shaped while, in ventral view, it is more M-shaped, with 2 sublateral, ventrally directed liplike lobes separated by a deep median groove. Median sclerite of aedeagus broadly trough-like, distal arms barely indicated, gonopore large. Gonocoxites each with a prominent ventromedial lobe that articulates with a prominent, sclerotized, setose plate that is situated anteriorly between these lobes (Figs. 3–5). A moderately large, well-developed sperm pump present with internal spicules, a short but distinct ejaculatory apodeme, and a long sperm duct (Figs. 6–8). *Female*: Eyes small, widely separated, accompanied by broader than usual orbits, frons, and vertex; vertex slightly raised ridgelike, and, in front view, appearing broadly peaked dorsomedially; in dorsal and lateral views, eyes bulging out from head more than in most other species; ocular triangle present but small, a second small, facetless area present on inner dorsal angle of eye. Each claw with a tiny, erect, subbasal tooth. *Pupa* (only pieces available): Respiratory organ (gill) with 14 filaments. Larva unknown.

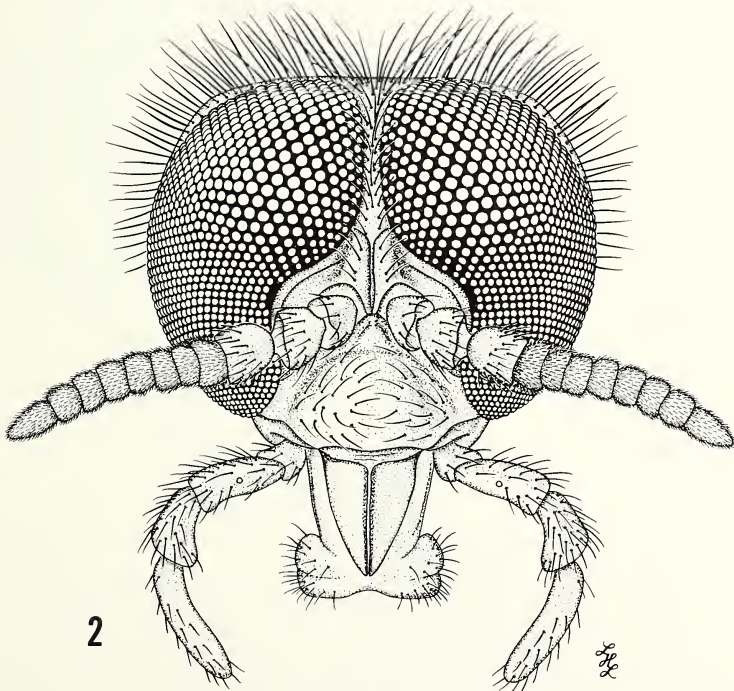
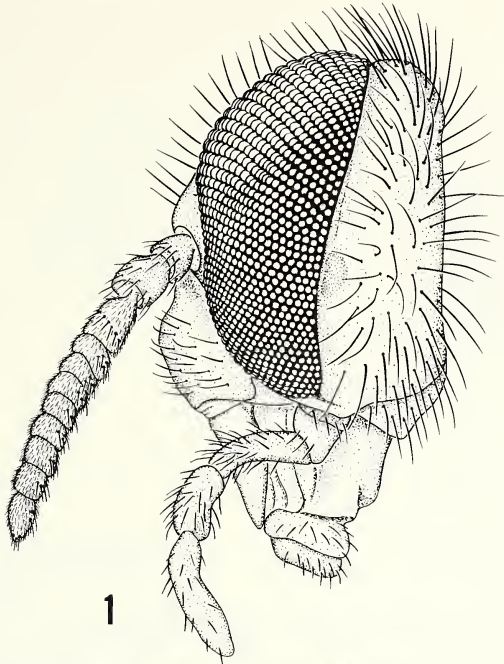
*Etymology*. The generic name is derived from *piezo*, Gr., meaning to squeeze, in combination with *Simulium*, and refers to the presence of a 'squeezing' organ or sperm pump in the male. Gender, neuter.

### ***Piezosimulium jeanninae*, new species**

Figs. 1–15

*Description*. MALE (preserved in alcohol): General body color blackish brown. Head (Figs. 1, 2) relatively small, with a slightly darkened spot along posterolateral margin of eye which might be a vestige of a stemmatic bulla. Clypeus small but strongly convex and protrudent well beyond front margin of eye, greatest width and length subequal. Occipital condyle small but conspicuous, strongly sclerotized. Occiput with dense, long, erect, black setae. Antenna yellowish; pedicel and first flagellomere subequal in length but pedicel slightly wider; fine pubescence pale yellowish, first flagellomere with a series of short, black, stout setae, these present also on ventral surface of other flagellomeres. Palpus yellowish, with black setae; palpomere 5 about  $\frac{2}{3}$  longer than palpomere 3. Sensory vesicle small, with a small, round mouth.

Antepnotum well developed, with moderately large lateral lobes connected by



Figs. 1, 2. *Piezsimulium jeanninae*. Male. 1. Head, lateral view. 2. Head, front view.

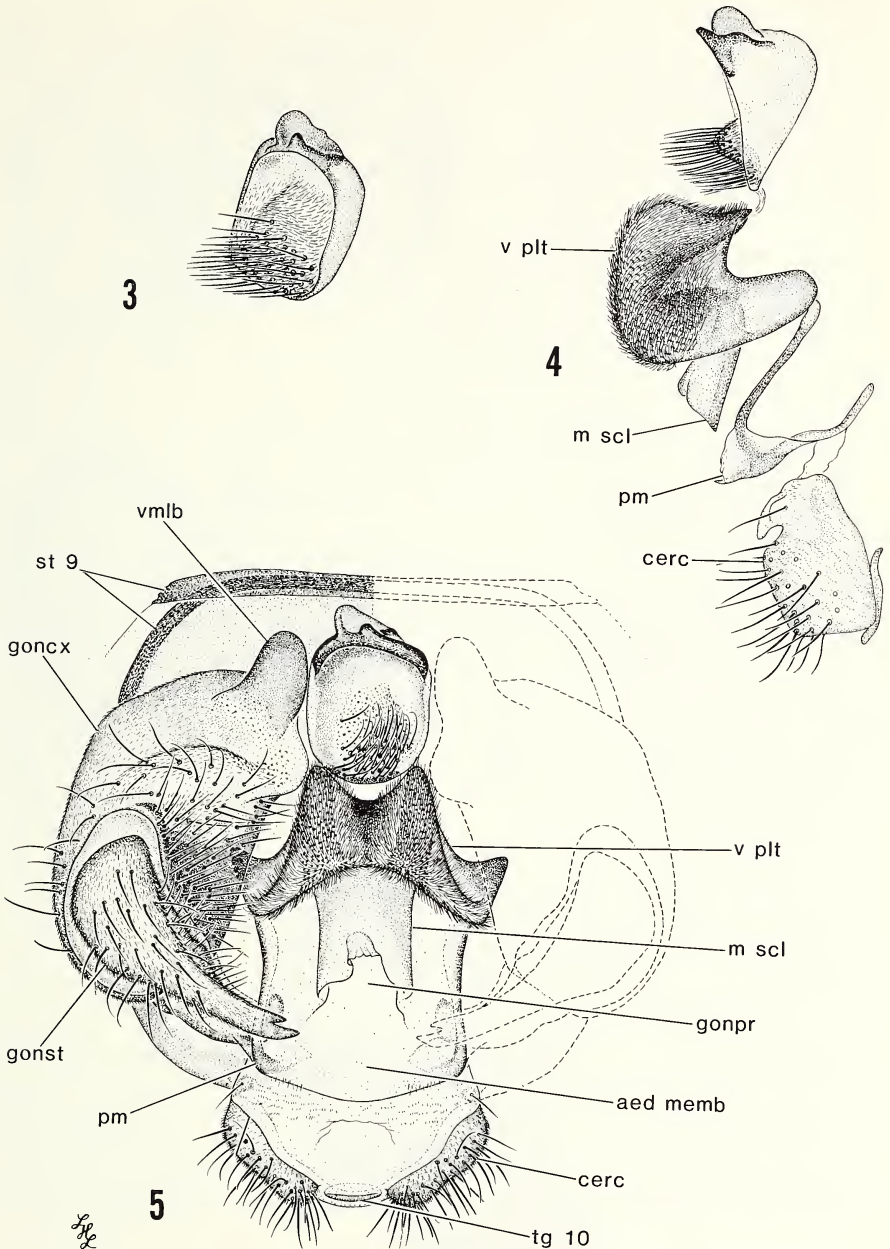
a broader than usual dorsomedial straplike portion; postpronotum somewhat reduced, subtriangular in shape; anteromedial portion of scutum broadly rounded and strongly arched; all preceding thoracic sclerites densely covered with short to moderately long, erect black setae, apparently without recumbent setae. Scutellum yellowish, brownish along margins, densely covered with long, whitish setae, most of which have dark bases. Postnotum somewhat narrowed and strongly convex. Anepisternal membrane broader dorsally, slightly tapered ventrally so it is roughly wedge-shaped; mesepimeral tuft dark, extending ventrally more than  $\frac{1}{2}$  height of posterior portion of mesepimeron.

Wing membrane hyaline but with a faint grayish tinge; veins pale grayish; base of costa with predominantly pale whitish setae but some setae with black bases and some entirely black; Sc with long setae ventrally; stem vein with whitish setae having dark bases;  $R_1$  and  $R_{4+5}$  setose both dorsally and ventrally,  $R_{2+3}$  bare dorsally, setose ventrally near tip; MA darkly pigmented; setae on other veins dark; fringe of calypter and anal lobe whitish. Halter shorter than in most other species; knob white, stem brownish yellow, its outer edge with a basal tuft of short, pale setae which is continuous with a row of similar setae extending dorsally to base of knob; at both ends of this series, setae are in double rows while medially they are in a single row; inner edge of stem with 2 setae at base, and with a single row of setae beginning at base of knob and extending nearly to top of knob, inner surface of knob with a patchlike series of minute setae.

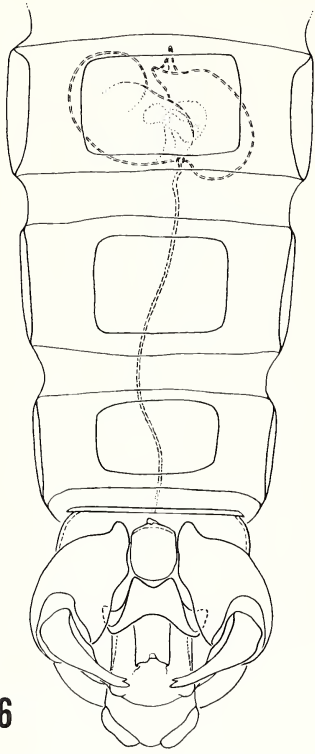
Legs in poor condition, but, in teneral state, appearing to be more yellow than body, rather slender and delicate; hind basitarsus about 3 times as long as broad. Claw long, slender, and slightly curved near tip, with a tiny basal tooth; dorsobasal toothlike process crescent shaped, about as broad as claw and about  $\frac{1}{2}$  as long as claw; empodium relatively long, slender, mostly yellowish, tip darkened and plumose.

Abdomen brownish black; basal scale (tergite 1) narrow, not as well developed as in other black flies, reduced dorsomedially to a narrow, straplike strip connecting somewhat broader lateral portions, at narrowest with only 1 or 2 rows of moderately long, dark setae, lateral portions more setose; remaining tergites all broad, sclerotized, with pale hind margins, and rather densely covered with moderately long, dark setae; tergite 10 small, subquadrate, smaller than cercus. Sternite 1 small, crescent shaped, lightly sclerotized; sternite 2 rectangular, weakly sclerotized, and bearing a patch of moderately long, dark setae (in other species sternite 2 is usually membranous and often bare); sternites 3–7 moderately sclerotized, densely covered with long, dark setae; sternite 8 more densely sclerotized, nearly bare except for about 18 short, dark setae posteriorly. Pleural membrane of segments 4–8 with a faint, but distinct, shagreened area consisting of numerous, closely placed, minute granules; spiracles of segments 4–7 placed in or next to these areas; pleural membrane of each segment sparsely setose.

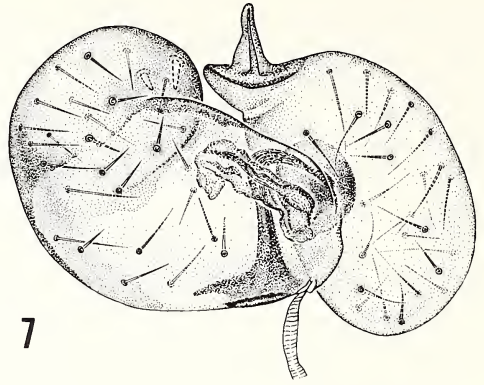
Terminalia as in Figures 3–9. Sternite 9 a slender, heavily sclerotized rodlike structure that is continuous dorsolaterally with tergite 9; slightly broader midventrally and with a short but distinct, irregularly pointed process on each side ventrolaterally (Fig. 5). Gonocoxite (Figs. 5, 6) stout, slightly wider than greatest length, with a distinct constriction, or depression, at about apical  $\frac{2}{3}$  and sparsely covered with pile distal to this constriction; inner proximal corner produced as a short but prominent, stout, sclerotized process that apparently articulates medially with a large, somewhat



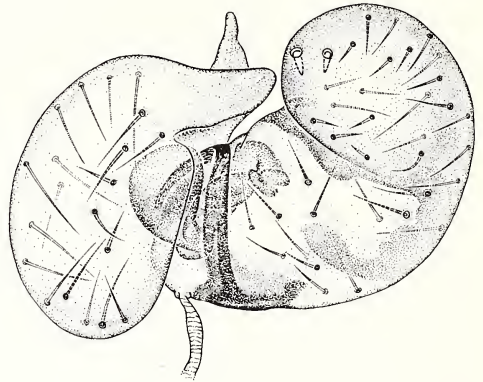
Figs. 3-5. *Piezosimulium jeanninae*. Male. 3. Sclerotized, setose plate, ventrolateral view. 4. Terminalia, lateral view. 5. Terminalia, ventral view. Abbreviations: aed memb, aedeagal membrane; cerc, cercus; goncx, gonocoxite; gonpr, gonopore; gonst, gonostylus; m scl, median sclerite of aedeagus; pm, paramere; st 9, sternite 9 (hypandrium); tg 10, tergite 10; vmlb, ventromedial lobe of gonocoxite; v plt, ventral plate of aedeagus.



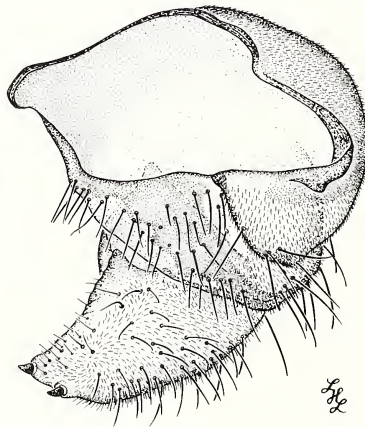
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Figs. 6-9. *Piezosimulium jeanninae*. Male. 6. Abdomen, ventral view, showing position of sperm pump in relation to abdominal segments and terminalia. 7. Sperm pump, dorsal view (?). 8. Sperm pump, ventral view (?) (it is uncertain which is true dorsal and true ventral because

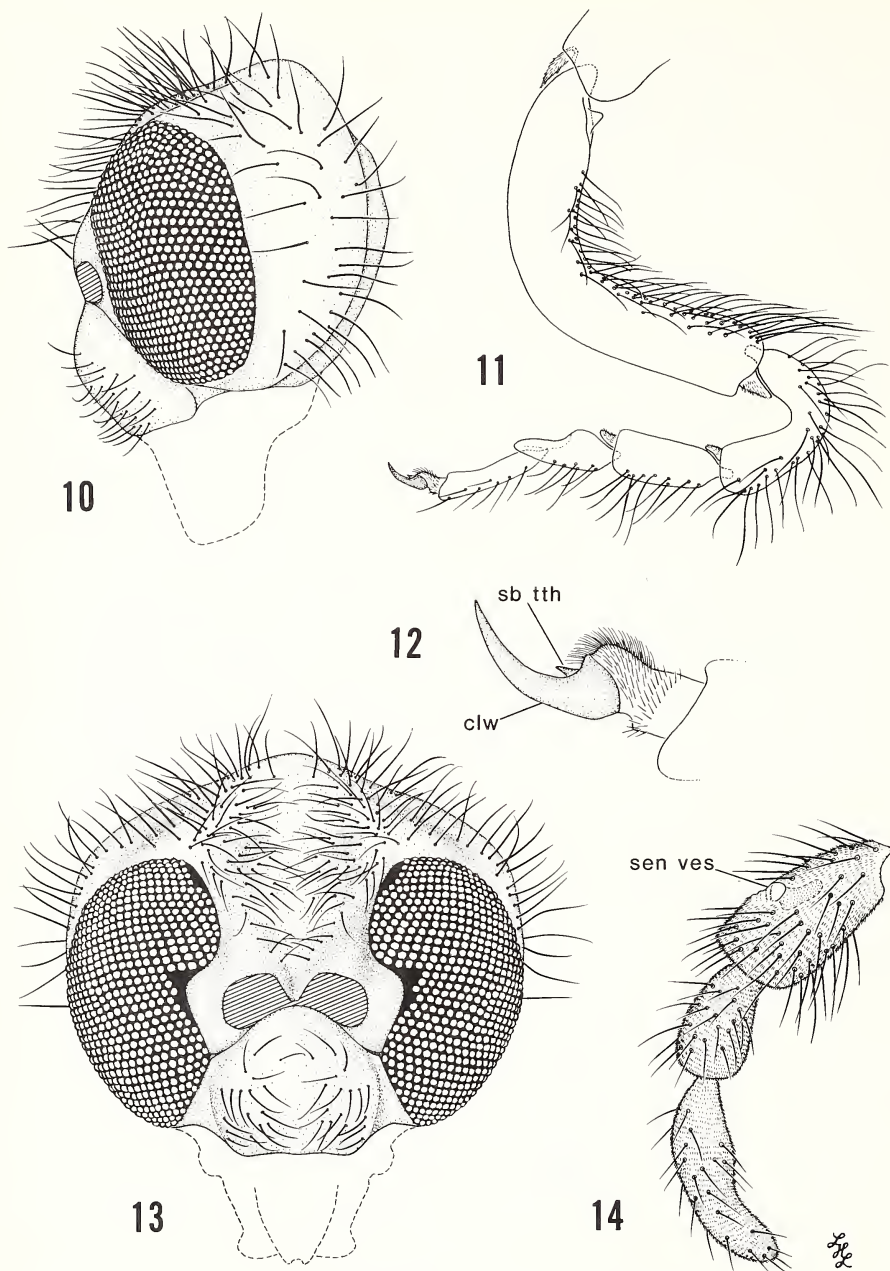
ovate, cuplike sternite (possibly a remnant of sternite 9 (hypandrium)); this sternite (Figs. 3–5) with anterior margin heavily sclerotized and bearing a short, submedian apodemelike process, ventral surface bearing a patch of long setae, posterior margin narrowly but heavily sclerotized and situated close to anteroventral surface of ventral plate of aedeagus (Figs. 4, 5). Gonostylus (Figs. 5, 9) short, stout, a curved triangular shape, slightly but distinctly longer than greatest width at base; pointed apically with 1 small, apical, and 1 subapical spine; moderately setose. Ventral plate of aedeagus (see generic description) (Figs. 4, 5) broad; in ventral view, M-shaped, widest at junction with basal arms, tapering distally, distal margin bilobed with a deep concavity between lobes, these lobes densely setose, proximal margin of ventral plate convex; basal arms short, slender and straight; in lateral view, with a deep ventral lip that is about  $\frac{2}{3}$  as deep as ventral plate is long, arm wide (Fig. 4). Stem of median sclerite trough-like, broader than medial groove of ventral plate, rather heavily sclerotized, distal arms essentially undeveloped, gonopore broad (Figs. 4, 5). Plate of endoparameral organ subtriangular, moderately sclerotized, connecting to tip of arm of ventral plate by a long, slender, heavily sclerotized rod, and to base of gonocoxite by a short, broad arm (Figs. 4, 5). Sperm pump (Figs. 6–8) lightly sclerotized but conspicuous, moderately large, about  $\frac{1}{2}$  as wide as abdominal segment, floating free in abdominal cavity in, or somewhere near, segment 6; bilobed with each lobe again curved, twisted or folded so it in turn is somewhat bilobed; 1 main lobe with a short but well-developed and heavily sclerotized ejaculatory apodeme on anterior border, area surrounding ejaculatory apodeme distinctly brownish; other lobe with a somewhat T-shaped sclerotized thickening near where sperm duct emerges; a sclerotized, tubelike process, with internal circular thickenings, also present which seems to join 2 main lobes together internally (this not clearly discernible in specimen at hand); inner surface of sperm pump with numerous moderately long spicules (or setae), and with 2 relatively long (but shorter than spicules), stout, dark spines on inner anterior surface of lobe not bearing ejaculatory apodeme, this portion of lobe distinctly brownish.

**FEMALE** (preserved in alcohol): General body color blackish brown; wing crumpled; most of abdomen missing. Head (Figs. 10, 13) relatively small; frons at vertex about  $\frac{1}{4}$  wider than at narrowest point, and nearly  $\frac{1}{2}$  width of head; about twice as wide as long; ventral area of frons, just dorsal to antennae, produced as 2 small but distinct, subshining humps, or calli, separated by a depressed area along midline; this midline bare, remainder of frons densely covered with moderately long, erect to semi-erect, black pile. Clypeus small, strongly convex; slightly wider than long; moderately covered with moderately long, black setae; in lateral view, both lower margin of frons (humps or calli) and clypeus projecting well beyond anterior margin of eye. Postcranium with combined ventral hypostomal bridge and postgenal areas about  $\frac{2}{3}$  longer than dorsomedial occipital sclerite. Occiput densely covered with long, black pile; usual long, stiff, postocular setae absent or undifferentiated. Antenna with scape

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the abdominal muscles were almost completely deteriorated and the sperm pump was free to move around inside the abdomen). 9. Right gonocoxite and gonostylus, dorsal (inside, upper) view.



Figs. 10–14. *Piezosimulium jeanninae* Peterson. Female. 10. Head, lateral view (antennae missing). 11. Tarsal segments of hind leg. 12. Claw, lateral view. 13. Head, front view (antennae missing). 14. Distal 3 palpomeres. Abbreviations: clw, claw; sb tth, subbasal tooth; sen ves, sensory vesicle of third palpomere.



and pedicel brown, slightly darker than flagellum which is more yellowish brown; pedicel and first flagellomere subequal in length and width; fine pubescence pale yellow, longer setae dark. Mandible and blade of maxilla present but weakly sclerotized; mandible with, at most, faint marginal undulations and a few very minute, irregular, serrations apically; blade of maxilla without retrorse teeth but may have 2 or 3 minute, setalike projections apically. Palpus short, pale yellowish, distal 2 palpomeres slightly lighter than palpomere 3; with pale and black setae; palpomere 5 slightly longer than 3, and about  $\frac{1}{3}$  longer than palpomere 4. Sensory vesicle small, slightly less than  $\frac{1}{3}$  as long as its segment, rather centrally situated, its neck short, arising anterodorsally and extending vertically, with an enlarged round mouth. Cibarium weakly developed, median proximal space deep, broadly U-shaped, dorso-lateral arms long, slender, only moderately sclerotized, nearly as long as remainder of cibarium.

Antepronotal lobes basically as in male. Postpronotum small, distinctly paler than scutum. Anteromedial portion of scutum broadly rounded, slightly elevated ridgelike. All 3 of these thoracic sclerites densely covered with short to moderately long, erect to semi-erect, black setae, apparently without recumbent setae. Scutellum and postnotum essentially as in male. Anepisternal membrane rather broadly rectangular, pale whitish; mesepimeral tuft dark. Precoxal bridge present but weakened at points of attachment with proepisternum. Katepisternum, in lateral view, with anterior margin nearly straight, lower portion without the usual lobelike appearance; in ventral view, ventral margin only weakly bilobed.

Wing in poor condition, presumably as in male. Halter short, knob white, stem pale brownish yellow, with short, pale setae.

Legs in poor condition but all appearing to have a similar color pattern as follows: coxae and trochanters brown, those of forelegs each with a yellowish patch (this might darken with time); femora yellowish, narrowly brown distally; tibiae yellowish but with both bases and apices brown; basal tarsal segment of each leg yellowish on basal half and brown distally, remaining tarsal segments yellowish brown; all leg segments with dark setae. Claw short, weak, evenly curving from base, with a variably developed but small, subbasal tooth that is difficult to see except under high magnification; empodium as in male.

Basal scale (tergite 1) of abdomen narrow, yellowish, with a fringe of long pale yellow pile; remainder of abdomen missing.

PUPA: Respiratory organ (Fig. 15) relatively short, consisting of a short, slender base densely covered with minute granules, and with 14 filaments arranged in 3 groups all on short petioles: a dorsal group of 6 filaments in 3 pairs, a mediolateral group of 4 filaments in 2 pairs, and a ventral group either in 2 pairs (2+2) or branching 3+1 (d-v); filaments brownish gray basally and covered with minute granules, these granules rapidly decreasing in number and filaments becoming paler whitish distally. Head smooth, without pattern or granules; antenna of male reaching nearly to hind margin of head; antenna of female reaching hind margin of head; 2 sublateral setae present on each side near ventral margin of clypeus. Dorsum of thorax smooth, with only a faint, superficial, reticulate pattern; 2 long, simple, dorsal trichomes present on each side of thorax. Abdominal tergites 1 and 2 dorsally on each half with 5-7 short, fine setae, these usually bent or sinuous. Cocoon a thick, loosely woven, shapeless sleeve that covers most of pupa.

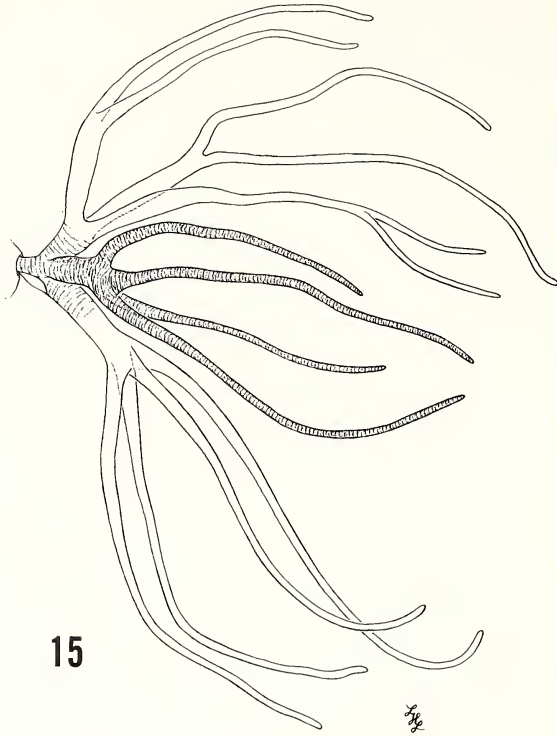


Fig. 15. *Piezosimulium jeanninae* Peterson. Pupa. 15. Respiratory organ (gill), right lateral view.

*Holotype*. Male (in fragmentary condition but abdomen well preserved), with portions of associated pupal pelt. North Boulder Creek, Boulder County, Colorado, elevation 3,600 m (11,811 ft), 11 September, 1981, John Bushnell (code 7). Deposited in the National Museum of Natural History, Washington, D.C.

*Paratypes*. Head and thorax of 1♂, 1♀, both removed from pupal skins (both in poor condition), same data and depository as for holotype.

*Etymology*. This species is named for, and dedicated to, my wife, Jeannine, who has been of inestimable help to me for nearly forty years.

*Biological notes*. The type locality is a small stream originating from the glacier on Niwot Ridge, near the Continental Divide, at an elevation of about 3,600 m (11,811 feet), in the controlled access area of the watershed from which the city of Boulder gets its drinking water. This stream continues in a variable path descending from its origin through a series of alpine lakes, named Green Lakes 2 through 5, and Albion Lake. The water temperature of the stream remains fairly constant in any given locality varying only from about 1°C near its origin to about 10°C near Albion Lake. It passes over a rocky bed with some moss and some trailing grasses, and through shifting muddy areas on its way down the slopes. Elgmork and Saether (1970) give an excellent description of North Boulder Creek and its environs. Other species

found in this stream include an undescribed species of *Prosimulium* Roubaud (near *P. neomacropyga* Peterson; reported as *P. ursinum* Edwards by Elgmork and Saether (1970), and Saether (1970)), *P. travisi* Stone (almost certainly the species reported as *P. esselbaughi* Sommerman by Elgmork and Saether (1970) and Saether (1970)), and a new species of *Metacnephia* Crosskey.

The specimens of *Piezosimulium jeanninae* were taken in association with specimens of the undescribed species of *Prosimulium* mentioned above and were not separated at first because both have 14 filaments in the respiratory organ (gill). However, the respiratory organs of the two species can be distinguished by the different textures of their component filaments and their overall shapes (see fig. 75, in Peterson, 1970). Specimens of the new species of *Metacnephia*, also taken in the same collection, were fewer in number than the new *Prosimulium* species but were more numerous than the specimens of *P. travisi* collected. However, subsequent collections resulted in large numbers of all stages of the new *Metacnephia* species.

*Remarks.* These descriptions are based, as noted previously, on fragmentary adult material salvaged from within pupal skins. Some of the fragments were in good condition, especially the abdomen and terminalia of the holotype male, and could be seen clearly within the pupal skins. At the same time, most portions of the specimens were quite fragile and in poor condition, especially since the specimens were partially decayed at the time they were collected. Handling and preparing this material for description and illustration also caused some damage to the specimens.

*Piezosimulium* belongs to the Prosimuliini as defined by Crosskey (1969), and as outlined in his recent (1987) checklist of world black flies. It would also be included in this taxon within the more restricted definition of the tribe given by Currie (1988). The features that are most characteristic and immediately distinguish males of this monotypic genus from all other known black flies are the conspicuous baglike structure that is here considered to be a sperm pump, and the distinct sclerotized, setose plate situated ventrally between the bases of the gonocoxites. This is the first record of such structures in the family Simuliidae, and I am not aware of any such sclerotized plate in any other dipteran. *Piezosimulium* also is readily distinguished from the other genera of Prosimuliini (and from all other simuliid genera) by a combination of several characters, but especially by the slender katapisternum (which is somewhat intermediate in development between that of the very reduced state found in *Parasimulium* (Peterson 1981), and the more usual development found in other genera such as *Prosimulium*, and the more apomorphic *Simulium* Latreille); the erect to semi-erect pile on the scutum (apparently without short recumbent setae) like in *Gymnopais* Stone, *Crozetia* Davies, and a few others; and the small and bulging eyes of both sexes (this character is also found in some other genera but the pattern of the large and small facets of the male eye is quite different from other known groups, and none seem to have eyes that so noticeably bulge from the head yet with the clypeus and lower frontal calli that project well beyond the anterior margins of the eyes).

Other features such as the larger quadrate calypter; the enlarged occipital foramen with the accompanying reduction of the dorsomedial occipital sclerite, and the concomitant longer hypostomal bridge and postgenal areas in both sexes; and the narrow, strongly arched condition of both the clypeus and postnotum in both sexes, probably are diagnostic in combination. However, it is impossible to evaluate the range of

Table 1. Distribution of some Character States in Simuliidae.

Character state	Piezosimulium	Prosimuliini	Parasimulium	Other Simuliidae
1	+	-	± (head distinctive)	-
2	+	±	-	±
3	+	-	-	-
4	+	-	±	-
5	+	±	-	-
6	+	-	+	-
7	+	-	+	-
8	+	-	-	-
9	+	±	?	±
10	+	-	-	-
11	+	-	-	-

Character states in <i>Piezosimulium jeanninae</i> (+)	Character states in other black fly genera (-)
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## Head

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| <ol style="list-style-type: none"> <li>1. ♂ eyes small, narrowly separated dorsally along medial margins; upper ommatidia gradually enlarging dorsally without a sharp line of demarcation separating them from smaller, lower ommatidia.</li> <li>2. ♀ eyes small and bulging.</li> <li>3. Clypeus small, strongly convex.</li> <li>4. Occipital foramen enlarged with accompanying reduction of median occipital sclerite, and longer hypostomal bridge and postgenal areas.</li> </ol> | <ol style="list-style-type: none"> <li>♂ eyes large, contiguous dorsally along medial margins; upper ommatidia abruptly enlarging dorsally and separated from smaller lower ommatidia by a distinct line of demarcation.</li> <li>♀ eyes usually large and not bulging.</li> <li>Clypeus larger, more flattened (less convex).</li> <li>Occipital foramen not enlarged, median occipital sclerite not reduced, and hypostomal bridge and postgenal areas not elongate.</li> </ol> |
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## Thorax

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| <ol style="list-style-type: none"> <li>5. Scutum dorsally with only erect to semi-erect setae (apparently without short, recumbent setae).</li> <li>6. Postnotum narrow, strongly convex.</li> <li>7. Katepisternum moderately slender, narrowly rounded ventrally, with a slight depression but without a distinct sulcus or groove separating upper and lower portions.</li> <li>8. Calypter enlarged, more quadrate.</li> </ol> | <ol style="list-style-type: none"> <li>Scutum dorsally without erect setae, but with abundant short, recumbent setae.</li> <li>Postnotum broader, more flattened (less strongly convex).</li> <li>Katepisternum broader and broadly rounded ventrally, with a distinct sulcus or groove separating upper and lower portions.</li> <li>Calypter smaller, more rectangular.</li> </ol> |
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## Abdomen

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| <ol style="list-style-type: none"> <li>9. ♂ abdominal sternite 2 sclerotized and setose.</li> <li>10. Sperm pump present.</li> <li>11. Setose, sclerotized plate present antero-ventrally between bases of gonocoxites.</li> </ol> | <ol style="list-style-type: none"> <li>♂ abdominal sternite 2 usually membranous, and bare or setose.</li> <li>Sperm pump absent.</li> <li>Without a setose, sclerotized plate antero-ventrally between bases of gonocoxites.</li> </ol> |
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variability, and the integrity of such morphological characters on the basis of the material at hand.

Depending on how the above mentioned characters are regarded, one could suggest that *Piezosimulium* really is the sister group of all other Simuliidae and should be placed in a separate subfamily; or that it is an aberrant, highly derived entity belonging to the Prosimuliini but on an evolutionary dead end. Another possibility is that it represents an oddity (of a type probably not to be encountered again) due to some miscued developmental factors. Neither of the first two possibilities can be unequivocally proclaimed until the character states of the adults and pupa are more fully known, and the larva is discovered and studied. The remarkably well-developed features of the male terminalia strongly argues against these features being artifacts or malformations resulting from the presence of mermithid nematode parasites or due to some other unknown factors that might cause unnatural development. It is difficult to conceive of a well-developed ejaculatory apodeme, albeit small, arising as the result of the presence of some parasite or miscued developmental factors especially since the presence of a sperm pump and ejaculatory apodeme has not been reported before in the Simuliidae. The same can be said about the presence of the setose, sclerotized plate situated between the bases of the gonocoxites, with its short but well-developed apodeme. None of the specimens of the associated species in this collection were parasitized or showed any evidence of parasites of any kind whose presence might have initiated the formation of such structures. It is equally difficult to conceive of the possibility that the baglike sperm pump is really some expression of 1 or more malformed spermathecae even though it possesses internal spicules (and 2 minute spinules) similar to those found in the spermathecae of some species. Again, it is difficult to conceive of the present specimens representing some type of sexual mosaic especially when such features as the sperm pump, ejaculatory apodeme, and the unique sclerotized plate have been unknown in the family.

Some form of sperm pump is found in most Mecoptera, all Siphonaptera, and is present in many of the families of lower Diptera that are widely recognized by dipterists as being among the most primitive of the living Diptera (see Downes, 1968). Downes (1968) also mentioned that the process of sperm transfer by sperm pump occurs in a rather precise, closed system as a fairly widespread primitive feature, and that the process usually cannot be completed very quickly. This is consistent with what can be surmised of *P. jeanninae*. In both sexes the eyes are greatly reduced which suggests that mating takes place on the ground over a period of time rather than in flights of short duration as occurs in the majority of other black flies. The high altitude habitat, with its relatively short summer season, cooler temperatures and more inclement weather patterns, is less conducive to mating during flight than it is in the more favorable conditions found in less severe habitats. The small eyes and the narrow postnotum suggest this species is not a strong flyer. Also, as the female is nonblood-feeding, I suspect that if this species flies at all it is only for short distances at any one time. The majority of other black flies are strong flyers and transfer sperm by means of a double-chambered spermatophore, usually, but not always, during a short mating flight. For such species at least initial coupling takes place in flight and mating may or may not be completed while still in the air. Downes (1968) called this process an open system that generally is faster and less precise than in the closed system by sperm pump. So far as is known, at least some representatives

of the other three families now included in the Chironomoidea, i.e., the Thaumaleidae (Downes, 1968:613; McAlpine, 1981), Ceratopogonidae, and Chironomidae, effect sperm transfer by a gelatinous, double-chambered spermatophore, but not by a sperm pump.

The unique sclerotized plate situated between the anteroventral (medial) corners of the gonocoxites, and anteroventral to the base of the ventral plate of the aedeagus, appears to be a relic (not just an artifact) possibly from sternite 9 (the hypandrium). This sclerite bears a distinct patch of moderately long setae ventrally and has a short, but distinct, submedian apodeme on its anterior margin which probably is a point of articulation with the main body of sternite 9. Additional specimens of *P. jeanninae* will be necessary for study before any homology of this structure can be resolved. As far as I am aware, none of the other three families presently constituting the superfamily Chironomoidea, has any structure that even vaguely resembles the sclerotized plate found in *P. jeanninae*, and, in fact, nothing similar is present in any other Diptera known to me.

Table 1 summarizes the character states mentioned above and their distributions generally within the family. It is not intended for concluding phylogenetic relationships; such conclusions would only be speculative until the larva of this species is discovered and studied and the adults and pupa are more completely known.

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